rocks of Logan, called Animikie, Nepigon, and Keweenian, by Dr. Hunt, and the unconformity of the Animikie divisions to the underlying Huronian, by some geologists in the United States supposed to be of the same age. (2) Mr. W. Saunders, of London, Ont., "On the Influence of Sex on Hybrids among Fruits." This paper gave some of the results of Mr. Saunders's experience in hybridising fruits. The facts cited confirmed the view that the influence of the female is more strongly expressed in the habit, character of growth, and constitution of the vine, bush, or tree, while the influence of the male is more distinctly seen in the form, colour, and quality of the fruit, and in the case of hybrid grapes in the size and form of the seeds also. (3) Mr. G. F. Mathew, of St. John, N.B., on "The Method of distinguishing Lacustrine from Marine Deposits," based on careful observations on the deposits now taking place and accumulated since the Pleistocene period in lakes in New Brunswick. (4) Dr. J. A. Grant, of Ottawa, on "The Inferior Maxilla of the *Phoca Grœnlandica* from Green's Creek, near Ottawa. (5) Principal Dawson, of Montreal, on "Spores and Spore-cases, from the Erian Rocks." The author referred to the discussion many years ago by the officers of the Geological Survey of a bituminous shale at Kettle Point, Lake Huron, of vast numbers of minute round disks, which were recognised as the spore-cases of some cryptogamous plant, and named *Sporangites Huronensis*. More recently Prof. Orton, of Columbus, Ohio, Prof. Williams, of Cornell, and Prof. Clarke, of Northampton, have found in the Erian and Lower Carboniferous shales of Ohio and New York beds replete with these organisms, and Prof. Orton has shown reason to believe that they are connected with filamentous stems found in the same layers, and also that they have contributed largely to the bituminous matter present in the shales in which they occur. Similar bodies have also been found associated with the curious plants known as Ptilophyton and Trochophyllum. Still more recently specimens from the Erian of Brazil have been sent to the author by Mr. Darby, of the Brazilian Geological Survey, which seem to throw additional light on these bodies. They are oval or rounded or in the form of flattened sacs, containing numbers of rounded disks, and so closely resembling the utricles or spore sacs of the Rhizocarps as to make it extremely probable that they belonged to plants of this class. Should this conjecture be sustained by subsequent inquiries it would show that this peculiar group is of much greater antiquity than hitherto supposed, and that these plants were extremely abundant in the shallow waters of the Erian period. Dr. Dawson suggests the probable relation of these singular fruits not only with the Ptilophyton, but also with the other Erian and Silurian plants. (6) E. Gilpin, jun., on "The Folding of the Carboniferous Group in the Maritime Provinces." The author described each of its great subdivisions as exposed at various points, and showed that during the Carboniferous period, in addition to the continental changes of level, giving rise to conditions of deposition characterising the carboniferous limestone, millstone, grit, &c., there were extensive foldings of a more local character, apparently in some cases marking the closing of these oscillations, These foldings and their subsequent denudations have played an important part hitherto but little studied in modifying the conditions arising from the larger and more extended movements which have hitherto principally received attention, and present the district as being far from an universal state of quiet and regular succession during the Carboniferous age. (7) Prof. R. Bell, M.D., on "The Causes of the Fertility of the Land in the Canadian North-west Territories." In the Canadian North-west a vast fertile tract stretches, with certain exceptions, from the Red River Valley to the Liard River, a distance of some 1400 miles. The soil of this tract was characterised as a dark loam, of varying depth, and of a nearly homogeneous consistency. The primary cause of the fertility of this region was the abundance of the underlying crude material out of which a finished soil could be made. This was derived partly from the widespreading crustaceous marls which were nearly coextensive with the fertile tract, and probably from the drift during the Glacial period. Dr. Bell next considered the process by which the black loamy soil was formed out of this subsoil, and he considered that the main agency was the work of moles and other burrowing animals. Worms appeared to be absent in the North-west, owing principally to the frost penetrating into the ground beyond the depth to which worms can burrow, but the moles and the ground squirrels, or gophers, more than make up for their absence. In the fertilised tracts the old and new mole-hills cover the whole surface, rendering it "hummocky," which may be easily observed after the prairie has been swept by a fire. The badgers often did what was compared to subsoil ploughing. All the animals referred to were very active in the autumn, digging many more burrows than appeared to be of any use to themselves. Each hummock thrown up by the moles covered about a square foot, and buried all the grass, &c., on this space. In this manner large quantities of vegetable matter were ultimately incorporated with the soil. The work of the moles also acted in another way in refining the soil, for they left behind the stones and coarse gravel, so that these in time became sunk beneath the layer of mould produced. By an interesting coincidence at the season when the burrowing animals are most active, the prairie vegetation is mature, and contains the largest amount of substance. The coldness of the soil during the most of the year tended to preserve the organic matter in it. While the circumstances given were the direct cause of its fertility, the ultimate reason was perhaps to be looked for in the climate of the North-west, for to this was due the growth of the vegetation which formed the manure and the food of the little workers which mingled it with the soil. Thus we could trace a mutual dependence of the circumstances which together have given to our North-west Territories that surpassing fertility of soil which cannot fail to attract to it a vast population. (8) Dr. G. M. Dawson, on "Notes on Triassic Rocks of the West," discussing the question as to the Triassic or Jurassic age of deposits found in British Columbia and the Rocky Mountains, and their correlation with the deposits of similar age in the territory of the United States. (9) Prof. L. W. Bailey, Ph.D., Fredericton, on "The Occurrence of Indian Relics in New Brunswick," probably deposits found at an old camping ground of the Malicete Indians. (10) Dr. T. Sterry Hunt, on "Studies on Serpentine Rocks." (11) Prof. J. Macoun, on "Notes on Canadian Polypetalæ." The geographical distribution of these plants in Canada was discussed, and interesting facts were adduced in connection with the number of species and genera in each order which showed certain relations between the present flora and that which had existed in the Tertiary period. (12) A paper by Mr. R. Chalmers was communicated by Principal Dawson, in which facts were stated showing important erosion on the coast of the Bay des Chaleurs by floating ice in the modern and later Pleistocene periods.

Dr. Selwyn, Prof. Lawson of Halifax, and J. F. Whiteaves, were re-elected president, vice-president, and secretary of the Section respectively.

The following were the officers elected by the Society for the present year:—President, Hon. P. J. O. Chauveau, LL.D.; Vice-president, T. Sterry Hunt, F.R.S.; Hon. Secretary, J. G. Bourinot, B.A.; Hon. Treasurer, J. A. Grant, M.D.

THE HYPOPHYSIS CEREBRI IN TUNICATA AND VERTEBRATA

In most simple Ascidians the single nerve ganglion is situated near the anterior end of the body, and between the branchial and atrial apertures. In species where the atrial aperture is near or at the posterior end of the body, the ganglion may also be placed far back, but it still lies between the two apertures and always indicates the dorsal side of the branchial. The ganglion is usually elongated, and gives off nerves at both ends—one set anteriorly and ventrally towards the branchial aperture, the other set posteriorly and dorsally towards the atrial. In close relation with the ganglion are found two organs—the neural gland and the dorsal tubercle—which have been much written about, but apparently will bear a good deal of further investigation.

The neural gland lies upon the ventral and posterior face of the nerve ganglion, and consists of a number of more or less ramified cæcal tubules springing from a central space or tube immediately below the ganglion. The presence of this organ was first distinctly pointed out by Albany Hancock in 1868,[2] but until quite recently its function was not only totally unknown, but had been scarcely investigated.

The dorsal tubercle was described by Savigny in 1816[3] under the name of "tubercule antérieur." Since then it has received many names, but has usually been regarded as some sort of ol-

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[1] Abstract of a paper read before the Royal Society of Edinburgh, April 2.

[2] *Journ. Linn. Soc.* (*Zool.*), vol. ix.

[3] "Mémoires sur les Animaux sans Vertèbres," pt. ii. fasc. 1. (Paris, 1816.)

factory organ. It is placed on the dorsal edge of the anterior end of the branchial sac, behind the circle of tentacles, and usually in a distinct "peritubercular" area, a diverticulum from the prebranchial zone formed by a bending posteriorly of the dorsal ends of the peripharyngeal bands.

The dorsal tubercle is, in the simplest form known, a funnel-shaped depression having its wider circular open end separated from the prebranchial zone in front of the branchial sac by a raised edge or lip, while its opposite narrower end is continued into a fine canal running dorsally and posteriorly. This simple condition is found in *Molgula pedunculata*; in *Eugyra kerguelenensis* the aperture is still wide, although its edge is square in place of being circular. In other simple Ascidians the anterior half of the edge has been apparently pushed backwards, so as to become invaginated and closely applied to the posterior half, thus reducing the circular aperture to a crescentic or semicircular slit. This condition is found in *Corella parallelogramma*. In most other forms more or less complication is produced by the ends of the slit, or "horns" as they may be called, being prolonged, often to a very great extent, and coiled in various directions, sometimes producing beautifully regular and closely placed spirals. The patterns produced by this curving of the horns are very numerous and often complicated, but their value in classification is slight, since they differ sometimes to a considerable extent in individuals of the same species, and on the other hand are sometimes very similar in members of different genera or even families.

This variously-shaped organ is histologically merely a depression in the connective tissue of the mantle, lined by epithelium continuous with the squamous epithelium covering the prebranchial zone, but modified upon the edges of the slit into cubical or columnar ciliated cells. Since the time of Savigny it has been almost universally regarded as a sense-organ of some kind—probably olfactory or gustatory, or in some way capable of testing the quality of the inhalent current of water. The reasons for this view have been :—

1. The position of the organ at the entrance of the branchial sac where a sense-organ would be of great apparent value.
2. Its structure—a ciliated depression covered in part by columnar cells, some of which closely resemble sense-cells.
3. Its intimate relation with the ganglion, and the presence of a nerve arising from the anterior end of the ganglion, running towards the branchial aperture close past the dorsal side of the tubercle, and presumably supplying it with nerves.

In 1876 Ussow showed that the gland of unknown function lying below the ganglion had a delicate duct, lined by cubical epithelium, which ran forwards and opened into the tubular posterior end of the funnel-like depression forming the dorsal tubercle; so that the slit of the tubercle was thus shown to be merely the aperture of the duct from the neural gland. In 1881 Julin[1] confirmed this discovery, described minutely the condition of the gland, the duct, and the tubercle in several species of simple Ascidians, and declared that there was no connection between the nerve running from the ganglion to the branchial aperture and the tubercle, and that consequently the latter was not a sense-organ, and was nothing more than the opening of the duct. In a second paper, published shortly afterwards, Julin[2] described the condition of these organs in two additional species, and enunciated the theory, suggested to him by E. van Beneden, that the neural gland was renal in function, and was the homologue of the hypophysis cerebri of the vertebrate brain. In favour of this homology may be considered :—

1. The position of the gland upon the ventral surface of the nerve centre and above the pharynx.
2. Its glandular nature.
3. Its connection with the anterior end of the pharynx by a duct—Balfour, Kölliker, and others having shown that the hypophysis or pituitary gland in higher vertebrates arises as a dorsal diverticulum from the stomodæum, but afterwards loses this connection.

From my own observations I can confirm Julin's statement as to the presence of the duct from the neural gland and its connection with the slit of the dorsal tubercle, and, like him, I am unable to find any nerve supplying the supposed sense organ. I have, however, in several cases seen certain of the epithelial cells covering the edges of the slit which had a striking resemblance to sense-cells, such as those in the ectoderm of *Actiniæ*. This observation, taken along with Julin's descriptions, and especially with the condition of affairs in some specimens of *Ascidia mammillata* which I have recently examined, has suggested to me that possibly the dorsal tubercle may be *both* the aperture of a gland corresponding to the hypophysis and also a sense-organ, probably of an olfactory or gustatory nature.

Ascidia mammillata is one of the forms discussed by Julin in his second paper. It is a large species with the branchial and atrial apertures rather far apart, and the ganglion at a considerable distance from the anterior end of the body. Julin found that the neural gland in this species did not form the usual compact mass, but was in a somewhat rudimentary condition, and that besides having the usual duct running anteriorly to communicate with the pharynx by the dorsal tubercle it had also a number of short funnel-shaped apertures into the peribranchial or atrial cavity inclosed by the mantle; so that in this species the products of the gland might be excreted either into the branchial sac (pharynx) or into the dorsal part of the peribranchial cavity, the region into which the intestine and the genital ducts also open.

In two specimens of *Ascidia mammillata* which I had an opportunity of examining recently I found the neural gland in exactly the condition described by Julin, but its duct had no aperture into the pharynx, the dorsal tubercle being entirely absent. The small funnel-shaped apertures into the peribranchial cavity were numerous and well developed, so that in the case of these individuals the neural gland was connected with the cloacal part of the peribranchial cavity only, exactly the arrangement to be expected if the gland had a renal function. It seems possible to me that this, or something like this, may have been the condition of affairs in the primitive Chordata previous to the point of divergence of the Urochorda. There may have been a renal gland placed ventrally to the nervous system, not necessarily at the anterior end only, and opening on the surface of the body by one or more laterally-placed apertures,[1] this gland being represented in the Tunicata by the neural gland, and in the Vertebrata by the glandular portion of the pituitary body.

Then the dorsal tubercle apparently is or was a sense-organ—possibly placed at first on the surface of the body, since the anterior part of the pharynx develops from the epiblast as a stomodæum—and I think it probable that the connection of the tubercle with the duct of the neural gland may be an after-change, caused possibly by the enlargement of the pharynx into a branchial sac, and the development of the peribranchial chamber. It may readily be imagined how, as the result of the formation of these cavities, the neural gland would be brought into closer relation with the dorsal tubercle, and one or more of the funnel-shaped ducts of the gland might, after having been carried in from the surface by the formation of the lateral atrial involutions, come to open into the ciliated depression of the tubercle in place of into the peribranchial cavity, thus producing very much the condition described by Julin in his specimens of *Ascidia mammillata*. By suppressing the original openings into the peribranchial cavity and leaving merely the secondary opening into the pharynx by means of the dorsal tubercle, we arrive at the condition found in all ordinary Ascidians. It is not easy to see the reason for this change, as there is no apparent advantage to be derived from it, but there is probably also no disadvantage, since there is abundant communication between the branchial sac and the peribranchial cavity through the stigmata or slits in the wall of the former.

This suggestion as to the origin of the present structure of the neural gland and neighbouring organs in most Tunicata implies that the pituitary body in the Vertebrata, which has lost its connection with the exterior, and probably also its function, has a similar history. In this view I am encouraged by some remarks by Balfour,[2] from which it is clear that he considered the pituitary body, judging from its development, to have been originally a sense organ opening into the mouth, and possibly corresponding to the Ascidian dorsal tubercle. He has also suggested,[3] as an alternative, the possibility that the neural gland in the Tunicata may be the homologue of the vertebrate pituitary body. This is of course the theory supported by van Beneden and Julin, and is open to the objection that it does not account for the remarkable structure of the dorsal tubercle. The view I hold combines both of those above mentioned by considering the pituitary body as the homologue of the neural gland,

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[1] *Archives de Biologie*, vol. ii. p. 59.

[2] *Loc. cit.* p. 211.

[1] The lining of the peribranchial cavity, into which the ducts open in the Ascidian, is derived from the epiblast, being formed in the embryo by a pair of lateral involutions, which afterwards fuse dorsally.

[2] "Comparative Embryology," vol. ii. p. 359.

[3] *Loc. cit.* p. 360.

and as being therefore the rudiment of a primitive renal organ,[1] which opened by lateral ducts upon the side wall of the body; while the connection of the pituitary body with the stomodæum in embryo vertebrates is regarded as being not its original and proper duct, but a secondary connection, which has been formed with a lost sense-organ placed at, or in front of, the anterior end of the pharynx, and homologous with the dorsal tubercle in the Tunicata.

Ussow and Julin have conclusively shown that the dorsal tubercle is not *merely* a sense-organ. The complex structure which the tubercle usually presents seems to indicate that it is not *merely* the aperture of a duct. Whether, as I suggest, it may be a sense-organ into which the duct has come to open can scarcely be determined on the evidence at present in our hands. The lines of investigation which may be reasonably expected to throw additional light upon the matter are: (1) the exact course of development of the neural gland and the dorsal tubercle, and further information as to the pituitary body; and (2) the examination of the condition of the gland and its ducts throughout the Tunicata, and especially in a large number of specimens of *Ascidia mammillata*, a species in which these organs appear to be in a variable and highly interesting condition.

W. A. HERDMAN

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

CAMBRIDGE.—Mr. W. H. Caldwell, B.A., Fellow of Caius College, has been selected to proceed to Australia to endeavour to solve the important questions connected with the reproduction and the embryology of the Monotremata, which have so long baffled inquiry.

Mr. S. F. Harmer, B.A., of King's College, 1st Class in the Natural Sciences Tripos 1883, has been appointed Demonstrator of Comparative Anatomy, in the vacancy caused by Mr. Caldwell's resignation.

Mr. W. F. R. Weldon, B.A., of St. John's College, has been appointed Prosector to the Zoological Society.

Mr. J. Bateson, B.A., of St. John's College, is proceeding to North America to study the life-history of Balanoglossus.

Mr. J. Roberts, B.A., of St. John's College, has been appointed assistant to the Woodwardian Professor.

Prof. Macalister will hold a class in Osteology in the long vacation.

Dr. Humphry has been elected Professor of Surgery.

SCIENTIFIC SERIALS

THE *American Journal of Science*, July.—On the genesis of metalliferous veins, by Joseph Le Conte. From his study of the phenomena of metalliferous deposit by solfataric action at Sulphur Bank and Steamboat Spring, the author argues against Dr. F. Sandberger ("Untersuchungen über Erzgänge," Wiesbaden, 1882) that all lodes have been formed by deposit from solutions. In this important paper the conditions under which the deposits take place and the character of the solvents are fully discussed. Besides simple water, whose solubility is greatly increased by super-heat and pressure, the most active agency appears to be alkali in the form of alkaline carbonates or alkaline sulphides, or both. Such alkaline carbonate waters, ascending slowly towards the surface through underground fissures, gradually lose much of their solvent power both by cooling and by relief of pressure, and must of necessity deposit in their courses, and form metalliferous veins. In this way even cinnabar and gold may be precipitated. Other powerful agencies may be organic matter of universal occurrence in subterranean waters, and known to be potent in reducing metallic oxides and metallic salts. Mainly by these methods it is argued that alkaline waters at various temperatures, but mostly hot, circulating in all directions, but mainly up-coming, and in any kind of water-way, but mainly in open fissures, form by deposit mineral veins. Amongst the many subjects incidentally treated are: Association with metamorphism, variation in vein contents; variation of richness with depth; origin of alkaline and metallic sulphides; occurrence of gold; irregular, brecciated, contact, and other kinds of lodes.—Evolution of the American trotting horse, by Francis E. Nipher. By an ingenious process of calculation the author arrives at the conclusion that the maximum speed to which the American trotting horse will constantly approximate without ever reaching it is a mile in ninety-two seconds.—The burning of lignite *in situ*, by Charles A. White. The ignition of the lignite beds still burning in Montana, and of others long extinct in Colorado, Wyoming, Dakota, and elsewhere, is attributed mainly, if not altogether, to spontaneous combustion, according as the deposits become by erosion successively exposed to atmospheric influence.—On the paremorphic origin of the hornblende of the crystalline rocks of the North-western States, by R. D. Irving. An examination of about 1000 sections representing the crystalline schists, and eruptives and basic eruptives of a region 400 miles by 300, and of three distinct geological systems, showed the occurrence of no hornblende not clearly or very probably secondary to augite.—On the constituents of the meteorites which fell at Bishopsville, South Carolina, in March, 1843, and at Waterville, Maine, in September, 1826, by M. E. Wadsworth.—A simple method of correcting the weight of a body for the buoyancy of the atmosphere when the volume is unknown, by Josiah Parsons Cook.—Recent investigations concerning the southern boundaries of the glaciated area of Ohio, by G. F. Wright. The limit is determined by an irregular line running from Aurora near New Richmond, in a north-easterly direction through Chillicothe, Newark, Dunville, and Canton, to New Lisbon, near the Pennsylvanian frontier.—On the variation of the specific heat of water, by G. A. Liebig.

Bulletins de la Société d'Anthropologie de Paris, tom. v. fasc. v. 1882.—On the tribes of Terra del Fuego, by M. O. Beauregard.—A paper by M. G. de Rialle on M. O. Beauregard's views regarding the origin of the Dardous, communicated to the Society in April, 1882, in which M. de Rialle contests the opinion that the Thibetan races are Mongols. He considers that the monosyllabic character of their language is a distinct proof of their non-Mongolian origin, the Mongol being an agglutinated form of speech belonging to the Altaïc linguistic families. In reply to his objections M. O. Beauregard read a voluminous paper at a subsequent meeting, on the ancient and modern ethnography of Cashmere and Thibet, which is mainly based on Stanislas, Julien, Deguignes, and other older French authorities, and on modern English writers, more especially Major Biddulph, to whose important labours and accuracy M. Ujfalvy bore testimony in his defence of M. de Rialle's views.—Observations by M. Hamy on the anthropology of the Comalis of the East African coast.—Exposition, by M. de Nadaillac, of the scope and character of his work, "L'Amérique Préhistorique," presented by him to the Society.—Zoological observations in Equatorial Africa during M. de Brazza's expedition, by M. Cornevin, derived from the notes of the naturalist, M. Michaud. From these it would appear that in the valley of the Ogoone the climate is constant, the temperature standing generally at about 90° Fahr. Maize, manioc, and tobacco are grown. The people are courageous but peaceable. The sheep have no wool and only little hair. A dark, fierce race of cattle, feared by the natives, abounds in the forests, but there are no indigenous horses.—Observations on the Galibis, by M. Dally.—On the anthropological distinctions between the two races confounded under the common name of Kabyles, by M. Sabatier.—On the flint instruments, including a lasso of the Quaternary period, found in the gravel beds of Sarliève, by Dr. Pommerol.—On the horse of prehistoric and historic times, by M. Pietrement.—On the dental mutilations of the ancient inhabitants of Mexico and Yucatan, by M. Hamy.—On social instinct, by Madame Clémence Royer. This paper, intended to supplement the writer's larger work, "L'Origine de l'Homme et des Sociétés" (published in 1870), considers social instinct in relation to plants as well as to animals generally.—Craniological observations on a series of the crania of assassins, by M. Orchanski, considered specially with reference to the relation between the skull and the face. The author's determinaminations are in close accord with those of MM. Ten-Kate and Bordier.—On the existence of a rudimentary cæcal appendage in some of the Pitheci, by M. Hervé.—Remarks on certain differences between Catholics, Protestants, and Jews, as to the relations among them of deaths and births, by M. G. Lagneau. The author finds that the Catholics generally, with a somewhat higher natality, have a considerable infantile mortality, resulting in a correspondingly feeble increase of population, while among Protestants this increase is often much higher, notwithstanding a somewhat smaller natality, which, however, is corrected by a

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[1] Not the pronephros, since that is found along with the pituitary body in many vertebrates, but possibly more ancestral. Might it not be the homologue of the provisional trochosphere excretory organs described by Hatschek and others in *Polygordius* and some Mollusca?